

Work Plan

For

Analysis of North Dakota Lakes for Numeric Nutrient Criteria Support under Nutrient Scientific Technical Exchange Partnership Support (N-STEPS)

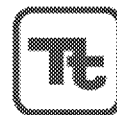
Prepared for:

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I. Goal:

The goal of this N-STEPS project is to conduct analyses in support of nutrient thresholds development to protect and restore lakes in North Dakota. This effort includes reviewing state narrative criteria, conceptual model development, reviewing and preparing data for analysis, analysis planning, conducting exploratory classification analysis, conducting stressor-response modeling, evaluating data gaps, and reporting.

II. Contact Information

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III. Project Background

North Dakota Department of Environmental Quality (DEQ) is seeking assistance analyzing a lake water quality dataset to support their efforts to interpret narrative nutrient water quality criteria.

DEQ has had several projects (e.g., Red River, Lake Sakakawea) related to identifying numeric nutrient thresholds for use in interpreting narrative water quality standards. They are seeking to expand beyond these single water efforts to regional translators specifically for lake ecosystems.

North Dakota, like many Plains states, has a diversity of lake/reservoir ecosystems from shallow, small Prairie Pothole to large, deep, complex reservoirs. Identifying thresholds will clearly involve both site specific and regional efforts, but they are seeking assistance from N-STEPS to help them with this effort and continue the process of improving nutrient reduction management across their state by identifying numeric thresholds associated with adverse responses in their lake populations.

Proposed Project timeframe:

From workplan approval until approximately May 31, 2020.

The dates provided below for specific tasks are contingent on project team availability and feedback and are to be viewed as a proposal rather than as absolute.

IV. Scope of Work

The following tasks will be executed under this N-STEPS work plan.

Task 1: Administration and Communication

N-STEPS will provide regular reports on progress and financial tracking of this project. In addition, N-STEPS will develop a schedule for and participate in regular conference calls including a kickoff call and webinars to communicate progress and solicit and incorporate feedback from participants.

Deliverables: Calls and progress reporting

Schedule: Ongoing

Task 2: Summary of state narrative nutrient criteria and consolidated listing and assessment methods for lakes and reservoirs

N-STEPS will provide a summary of state narrative nutrient criteria and how they are interpreted for assessment/listing, permitting, and TMDLs in lakes and reservoirs. It will include, but not be limited to the specific water quality parameters and their associated quantitative thresholds; and the locations, lengths, and frequencies of sampling; sampling and analytical techniques for

generating data. The project team will review and discuss examples of the narrative interpretations in the context of the conceptual model nutrient effects in lakes and reservoirs.

Deliverable: Review memo of state narrative nutrient criteria interpretation and iterations based on state feedback.

Schedule: August 29, 2019 (first draft); September 26, 2019 (final draft)

Effort: 24h

Task 3: Conceptual model of nutrient effects on lakes and reservoirs

N-STEPS will develop a conceptual model linking nutrient enrichment with biological and water quality endpoints influenced by excessive nutrients in North Dakota lakes. An attempt will be made to capture models for different types of lakes, starting with natural and man-made division. The goal will be to characterize major pathways through which nutrients influence endpoints in these waterbodies and the factors that affect those pathways, which include, but are not limited to lake morphometry, turbidity, color, wind and land use/land cover. The conceptual model will inform subsequent tasks on data acquisition and sharing (Task 4), data analysis planning (Task 5), exploratory classification analysis (Task 6), and stressor-response analysis (Task 7).

Deliverable: Conceptual model diagram in PowerPoint along with supporting description

Schedule: August 29, 2019 (first draft); September 26, 2019 (final draft)

Task 4: Data sharing, brief synoptic review summarizing existing data and previous analysis work, plan for data compilation, and data compilation

N-STEPS will initiate data exchanges with DEQ by establishing a centralized location (e.g., FTP, OneDrive or SharePoint) for sharing data and documents with participants (DEQ, EPA R8 and HQ, and Tetra Tech staff). Other easily accessible and “clean” datasets from neighboring states may be included in the analysis. National Lakes Assessment (NLA) data from ecoregions relevant to North Dakota will be considered for use to augment the dataset, but North Dakota specific NLA data are already incorporated into the state dataset. Consideration for incorporating landscape data (e.g., LakeCat predictors) will be discussed and potentially incorporated if desired. Lastly, incorporation of CyAN indicator data will be discussed and potentially incorporated if desired.

N-STEPS will develop a brief summary and meta-analysis highlighting the data sources, data compiled to date, and a plan for data sharing and any additional compilation/reconciliation effort and modify this pursuant to feedback from EPA or DEQ.

Deliverable: Brief summary of available data and data sharing and compilation plan.

Schedule: September 6, 2019 (first draft); September 27, 2019 (final draft)

According to the compilation plan, N-STEPS will organize lake data to be used for analysis including all the variables selected during discussion. The data will be shared and reviewed by the state to ensure its quality for analysis.

Deliverable: Database for analysis

Schedule: October 18, 2019 (first draft); November 8, 2019 (final draft)

Task 5: Data analysis planning

As part of regularly planned calls, the participants will discuss and refine desired outcomes of the empirical analyses to be conducted by N-STEPS, including those in support of classification and stressor-response analyses. N-STEPS will take the content of these discussions and develop an analysis plan to lay out the strategy for conducting the subsequent analyses. Participants will discuss treatment of non-detects, minimum sample size required for calculation of summertime average concentrations, waterbodies missing potential confounding factor information, how to ensure the analyses are not biased based on large datasets from individual waterbodies, etc. Decisions from these discussions will be documented in a data analysis plan that will be reviewed by EPA and DEQ and revised accordingly before proceeding with the bulk of data analysis. At this point in time, EPA anticipates having available some national models and/or tools for lake criteria development to share with ND which may be used as a resource for data analyses or comparisons.

Deliverable: Analysis Plan

Schedule: October 18, 2019 (first draft); November 8, 2019 (final draft)

Task 6: Exploratory classification analysis

Based on the analysis plan, N-STEPS will conduct exploratory classification analyses using a variety of standard methods for grab and seasonally-averaged data (e.g., simple descriptive statistics, regression trees, model based recursive partitioning). Common *a priori* classification structures will be explored (e.g., thermal regime, use class, elevation, residence time, etc.). Classification analyses will also be incorporated into the stressor-response analysis task – this task will primarily focus on *a priori* classification structures.

Deliverable: Summary classification analysis memo

Schedule: December 6, 2019 (first draft); January 6, 2020 (final draft)

Task 7: Stressor-Response analysis

N-STEPS will conduct stressor-response analysis to explore the relationship between nutrients (TN and TP) and response variables [e.g., pH and DO, algal biomass (chlorophyll-a), phytoplankton assemblage data, zooplankton, and cyanobacteria cell counts, and microcystin concentration]. The primary objective of this analysis will be to evaluate the potential influence of confounding factors, identify quantitative nutrient and chlorophyll thresholds associated with adverse response conditions and to identify data gaps to inform future sampling. The specific analyses used may include visual plots of interest, linear and nonlinear curve fits and interpolation, and thresholds determined using visual estimates with nonlinear and/or nonparametric models.

N-STEPS will also incorporate classification and confounding factor analysis into these stressor-response models. This may include use of model based recursive partitioning, multiple

regression models, ~~and even hierarchical models~~, and Bayesian network models comparable to those been used in national tools for lake criteria development. Important confounding factors for consideration include but are not limited to the N:P ratio, non-algal turbidity, residence time, and thermal regime.

N-STEPS will also examine the effect of averaging period (none, seasonal, annual, etc.) on the relationships.

Deliverable: Summary stressor-response analysis memo

Schedule: January 6, 2020 (first draft); February 3, 2020 (final draft)

Task 8: Data gaps

N-STEPS will evaluate potential data gaps such as whether there are sufficient data along nutrient gradients, for specific classification types, missing parameters, sufficient stressor-response data, etc. This information will be used to inform future state sampling/monitoring plans to address such gaps and improve future models.

Deliverable: Summary data gaps memo

Schedule: February 3, 2020 (first draft); March 2, 2020 (final draft)

Task 9: Technical report

N-STEPS will draft a technical report detailing all tasks undertaken in this project. The project team will review and provide written and verbal comments on the draft report(s). The technical report will be finalized and delivered to DEQ upon completion of the project.

Deliverable: Technical report

Schedule: First draft due within 30 calendar days after Task 8 is completed; Final draft due within 60 days following delivery of the first draft.